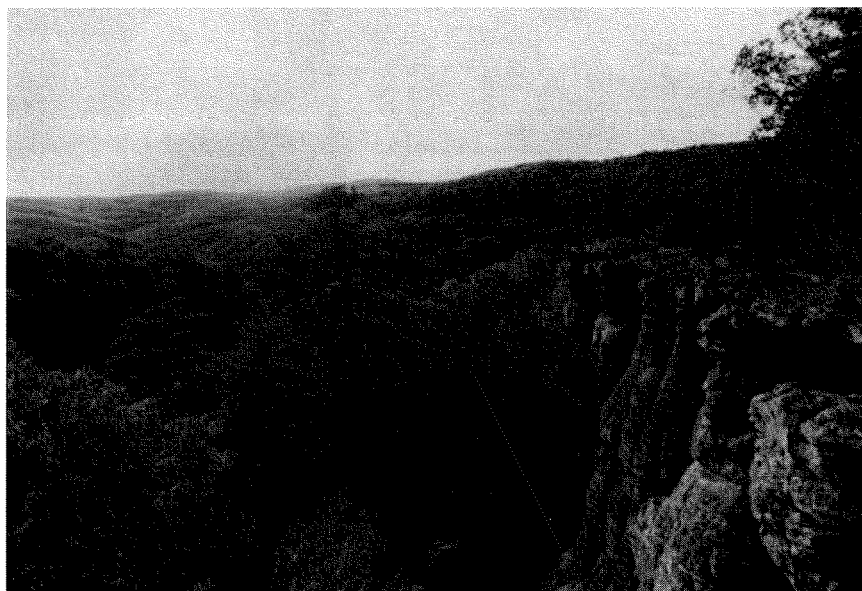


Summary of Findings



A.C. Haralson

David N. Wear and John G. Greis

ABSTRACT

The Southern Forest Resource Assessment (SFRA) was initiated in spring 1999 to address broad questions concerning the status, trends, and likely future of southern forests. A descriptive assessment such as SFRA can be used to highlight the major dynamics and uncertainties at play within a region's forested ecosystems, thereby focusing public discourse. Because SFRA has only recently been completed, however, it is too early to examine its effectiveness as a basis for debate and policy. This summary describes five major forces of change affecting southern forests and then characterizes the trends in various forest conditions and their implications.

Keywords: future of forestry; inventory and analysis; sustainable forestry; timber markets

In conducting the Southern Forest Resource Assessment (SFRA), government was evaluating a largely private sector—89 percent of the South's forests are held by private owners. The goal was a thorough and objective description of forest conditions and trends in the South, compiled in a way that would help the public understand a complex and dynamic resource situation. This role-describing cumu-

lative change in private forestry on a broad scale has been called a logical and important role for government (National Research Council 1998).

The southern offices of the USDA Forest Service, Environmental Protection Agency, Fish and Wildlife Service, and Tennessee Valley Authority chartered SFRA, and it was conducted in collaboration with state agencies represented by the Southern Group of State

Foresters and the Southeastern Association of Fish and Wildlife Agencies.

The draft assessment report was issued in November 2001, and the final report will be released soon. Complete SFRA findings are presented in 23 technical chapters and two background papers (on forest history and fire), available at www.srs.fs.fed.us/sustain; a summary report (Wear and Greis, in press) represents a distillation. What follows is an even more compact description of major findings.

FORCES OF CHANGE

The forests of the South are diverse (fig. 1) and dynamic, and their current conditions reflect the legacies of a long history of land use, including the in-

Above: Autumn in Kings Bluff in the Ozark Mountains of Arkansas.

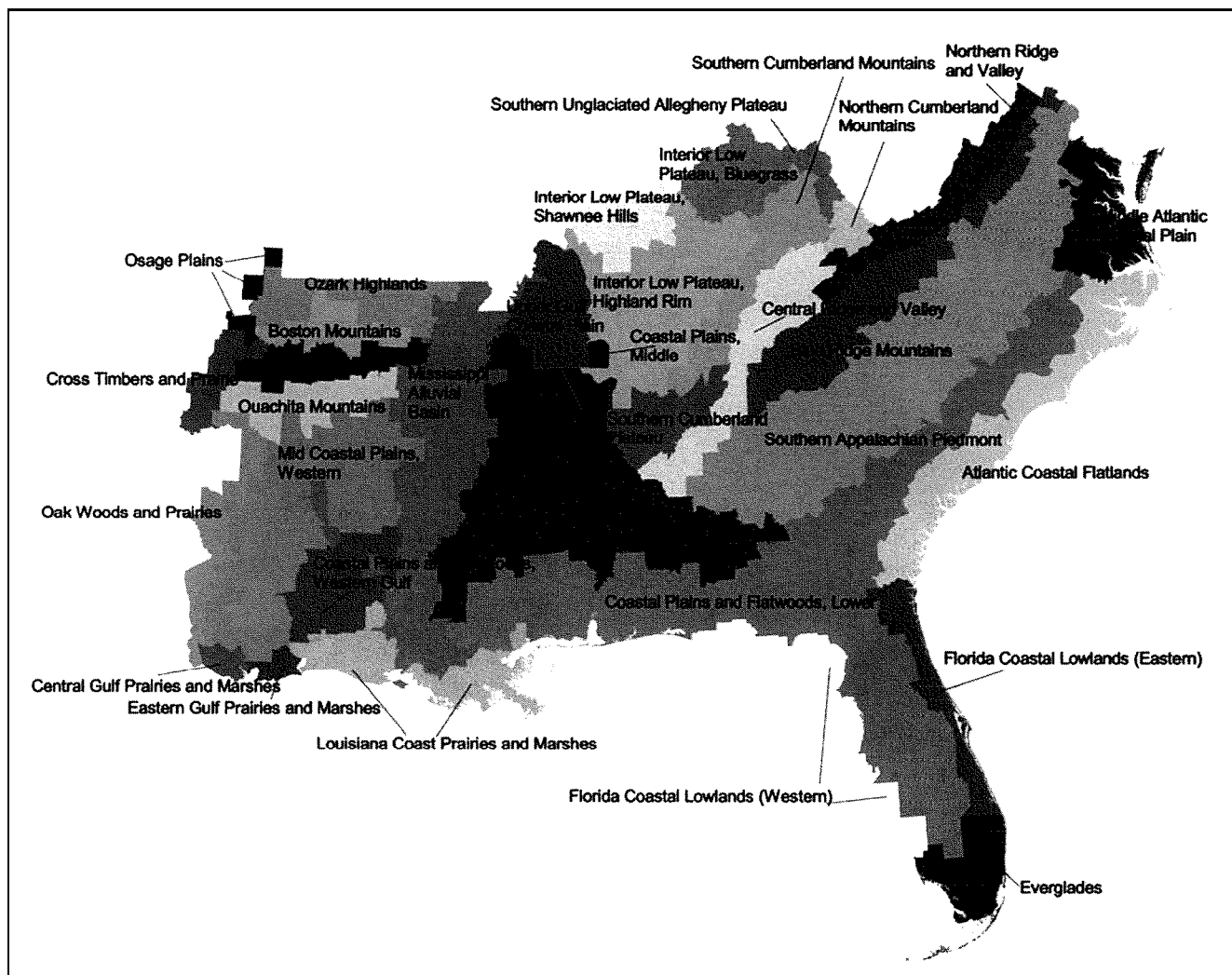


Figure 1. Ecological sections of the South. Source: Wear and Greis (in press).

tensive agricultural exploitation of the 19th century and forest recovery at the beginning of the 20th. In the last quarter of the century, however, timber harvesting and development for urban uses increased substantially. Landownership patterns also changed, with continuing trends toward smaller tract sizes and changing management preferences. Meanwhile, nonnative forest insects and diseases and exotic plant and animal species have altered much of the South's forests. Institutional factors—laws, regulations, government programs—have had varying effects on the forestland base and its management. As a result, many have questioned the health, productivity,

and ultimately the sustainability of the South's forests and the benefits they provide.

Land Markets

From 1700 to 1930, land clearing for agriculture and timber production completely restructured southern ecosystems. Clearing for agriculture greatly diminished the area of forested wetlands, especially in the Mississippi River Alluvial Valley. Wholesale land abandonment then set the stage for a long period of forest reestablishment and growth.

Since the 1940s there has been little net change in forest area in the South. Current forest area is 214 million acres,

including about 201 million acres of timberland. However, there have been large offsetting changes: Forests have been converted to urban and agriculture uses in some places, and agricultural land has been converted to forests in others.

Forecasting models indicate that 12 million forest acres will be lost to urbanization between 1992 and 2020 (fig. 2, p. 8), and an additional 19 million acres between 2020 and 2040. Most forest loss is expected to be concentrated in the eastern part of the South. These losses are forecast to be partially offset by conversion of 10 million acres from agricultural land to forestland between 1992 and 2020, with conversion of another 15 million

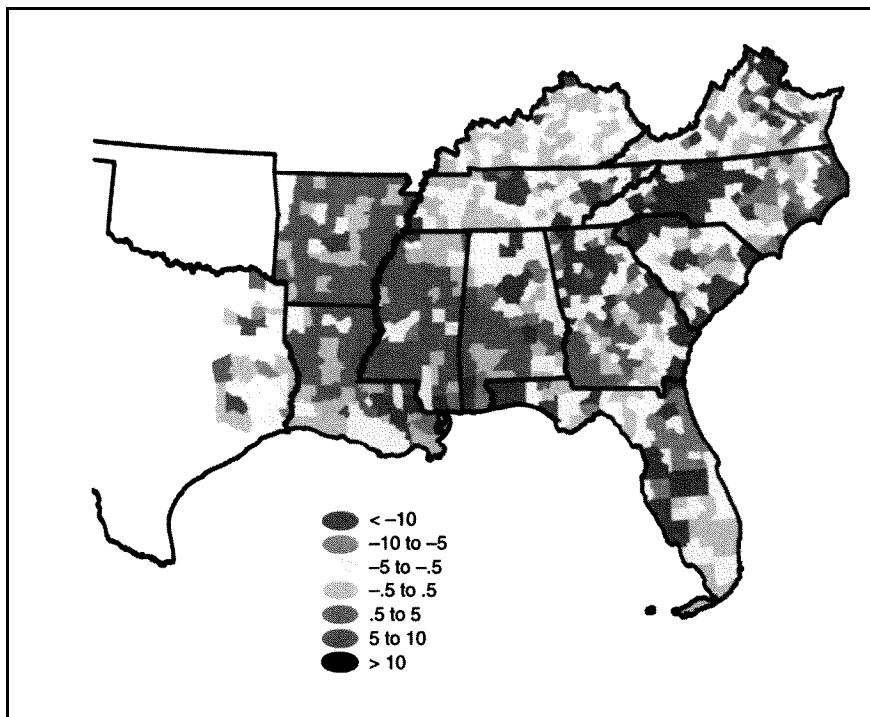


Figure 2. Forecast percentage change in forest cover, 1992–2020.

acres, mostly in the western part of the South, by 2040. These new forests will likely be planted pine, except in the Mississippi Alluvial Valley, where **bottomland** hardwood restoration is expected to predominate.

Timber Markets

Between 1953 and 1997, the South's timber production more than doubled, its share of US production increased from 41 to 58 percent (*fig. 3*), and its share of world production increased from 6.3 to 15.8 percent. The region now produces more timber than any other country in the world.

The mix of wood products from the South is diverse (*fig. 4*). The largest categories include softwood **sawlogs** (28 percent), softwood pulpwood (25 percent), and hardwood pulpwood (16 percent). Since 1953, hardwood pulpwood has experienced the greatest increase in product share, growing from 3 to 16 percent of output.

Timber market models forecast that timber production in the United States will increase by about one-third between 1995 and 2040. Nearly all of this growth will come from the South, where production is forecast to increase 56 percent for softwoods and 47 percent for hardwoods.

Social Institutions

Laws, regulations, and government programs are frameworks within which forests are managed. Forest health, ownership patterns, productivity, and value for wildlife habitat are all affected by these social institutions.

In the largely private forests of the South, the current income tax code has mixed impacts on long-term investments in forestry, but inheritance taxes were found to encourage owners to liquidate or split up forest properties.

Landowner assistance and incentive programs that subsidize tree planting have had a long and successful history in the South and have contributed to the region's prominence as a wood producer. More recent programs are focusing on other forest values.

Direct governmental regulation of forestry is very limited in the South. However, in urbanizing areas, proliferating local regulations affect land use and forest management. The expansion of local regulations—which nearly doubled between 1992 and 2000—appears closely linked to population growth and urbanization, and the number of regulations affecting forest treatments will likely continue to expand in high-growth areas.

Biological Factors

Native diseases and insects that affect stand composition, stocking levels, and spatial configuration of pine forests have become problematic. Southern pine beetle and fusiform rust are significant pests; the former is expected to cause substantial economic damage and ecological change in the South, especially on heavily stocked nonindustrial private and aging public forests.

Chestnut blight removed an important canopy species beginning in the 1930s, and nonnative diseases and insects continue to alter southern hardwood forests. Serious species-specific diseases (including dogwood **anthracnose**, oak wilt, and butternut canker) and exotic insects (including gypsy moth, balsam woolly adelgid, and hemlock adelgid) have been introduced.

Nonnative trees, shrubs, vines, birds, mammals, and aquatic species are having large impacts on southern ecosystems. Expansion of urban areas will likely increase the spread of exotics and exacerbate their impacts on native plant and wildlife communities.

Physical Factors

Many southern forest types are fire adapted, and exclusion of fire has altered their species composition, flammability, and management. Changes in the ambient environment are also influencing forest growth and vigor.

Ozone pollution is forecast to increase from 20 to 50 percent between 1990 and 2025, reducing growth in southern pines. Future changes in temperatures could positively or negatively affect forest growth and species ranges, depending on the extent of the change and availability of moisture. Acid deposition is not expected to be a problem except in the southern Appalachians. The reintroduction and continued use of fire will remain challenges as urbanization and air pollution concerns limit its use.

SOUTHERN FOREST CONDITIONS

To ascertain the current status and potential future of various aspects of forest conditions and the services and direct benefits they provide, we examined southern forests from four perspectives: (1) social and economic systems; (2) for-

est area and condition; (3) terrestrial ecosystems; and (4) water quality, wetlands, and aquatic ecosystems.

Social and Economic Systems

The population of the South has grown faster than national averages, and the share of the US population residing in the South now exceeds 32 percent. Although growth was largely in urban areas through 1980, it is now occurring across nearly all southern counties (*fig. 5, p. 10*). The demographic shift has been accompanied by a shift in values, from a strong commodity orientation to a more biocentric view.

Population is forecast to continue growing in absolute terms and relative to the United States as a whole, putting increasing pressure on forests, especially in urbanizing areas—Atlanta, Nashville, and Charlotte and along the Atlantic and Gulf coasts. The wildland-urban interfaces affect many forest values and present significant management challenges.

Wood products. With expansion in forest production has come an expansion in jobs and income from the wood products industry. In 1997, timber harvests led to more than 700,000 jobs in the wood products sector and more than \$118 billion in total industry output. Total economic impacts of these activities were about 2.2 million jobs (5.5 percent of total jobs in the region) and \$251 billion of total industry output (7.5 percent of all industry output).

Timber harvesting and management for timber production are prevalent in all parts of the region but concentrated on the Atlantic and Gulf Coastal Plains. Timber production is forecast to remain strong in these core areas but gain share especially in Tennessee, North Carolina, Arkansas, and western Virginia. Considerable public debate about harvesting practices and forest sustainability in these areas is likely to ensue.

Recreation. Recreation is an important source of employment and income in the South. In 1997 outdoor recreation-based tourism accounted for 0.64 to 2.88 percent of southern jobs. Public lands represented 56 percent of this share. Driven by a growing popu-

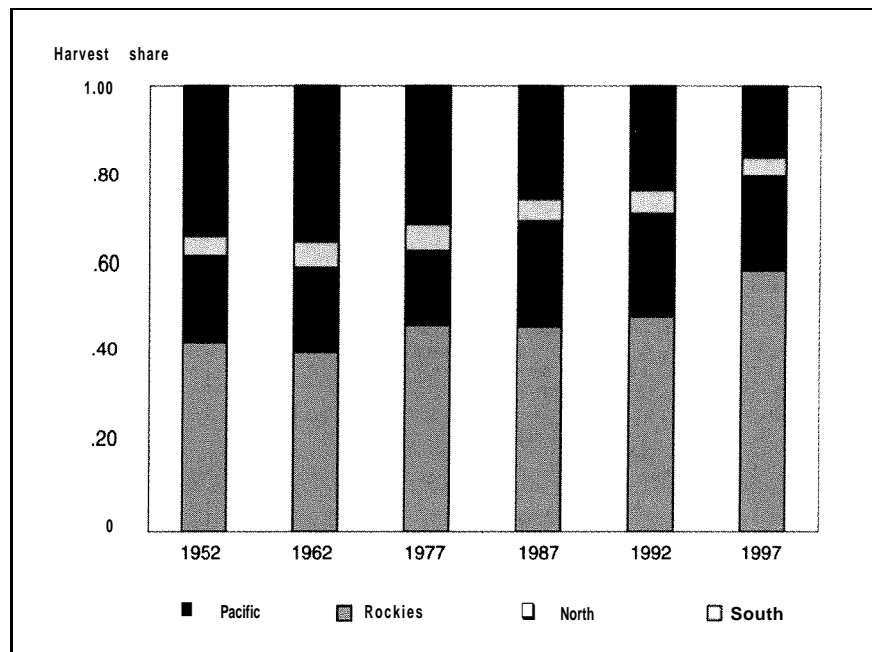


Figure 3. Shares of timber harvest volumes, by region of the United States, 1952 to 1997.

Source: Wear and Greis (in press).

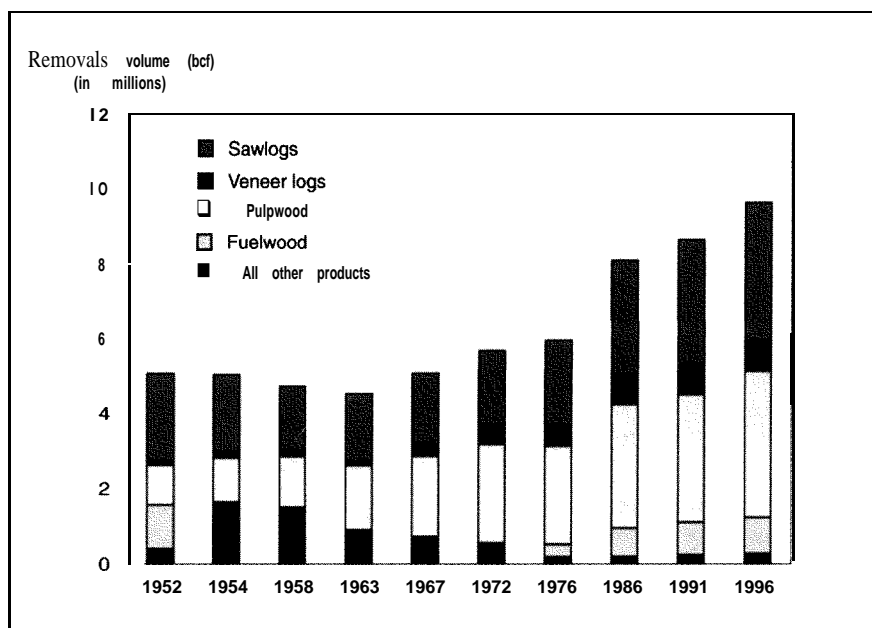


Figure 4. Removals by destination product across the South, all species, 1952 to 1996. **Source:** Wear and Greis (in press). **Note:** Data for 1954 to 1972 on "All other products" include fuelwood.

lation and changes in income and other demographics, recreation uses of all types have increased, and recreation pressures on public land are substantial. This trend is expected to continue.

Given current landownership patterns, capacity to expand forest-based recreation opportunities in the South is limited. Public land is therefore expected to be increasingly congested,

and competition (and conflict) among various recreation groups will likely increase.

Forest Area and Conditions

Forest area and ownership. The South's 214 million acres of forestland constitutes 60 percent of what existed in 1630 and 91 percent of the total area in 1907. Total forestland is fore-

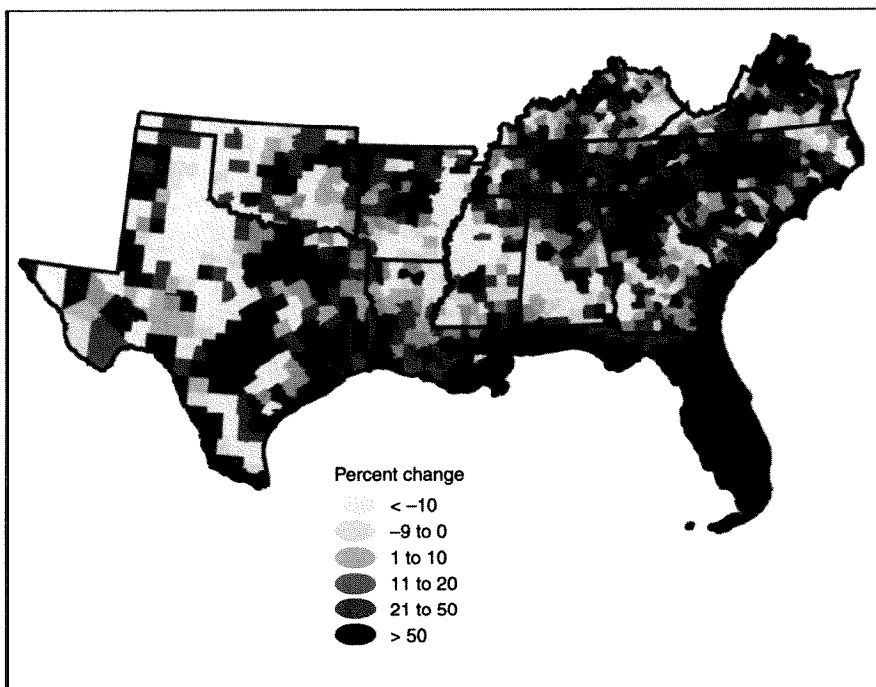


Figure 5. Percentage changes in the density of population, 1950–2000.

Source: Wear and Greis (in press).

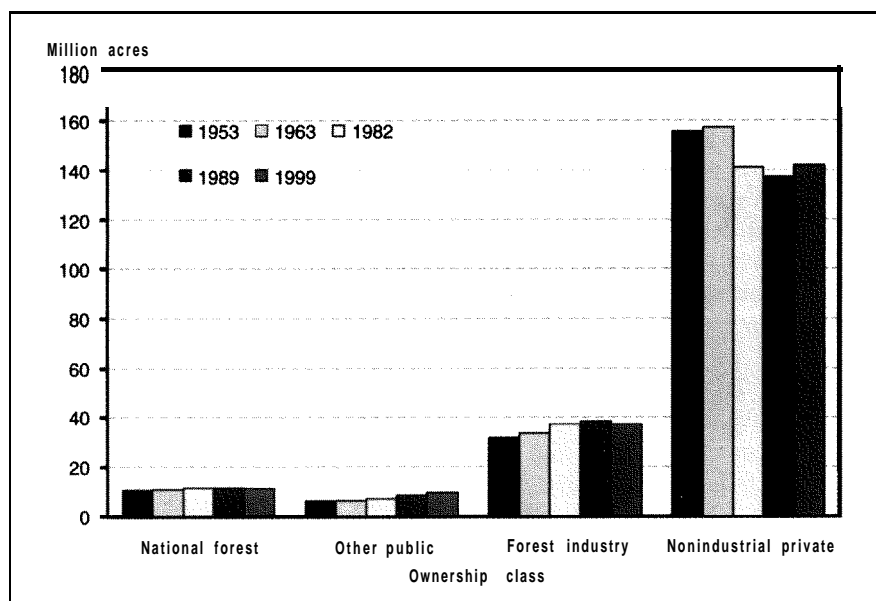


Figure 6. Timberland area by ownership class and year, southern United States.

Source: Wear and Greis (in press).

cast to decline by 2 percent between 1995 and 2040, with declines concentrated in the eastern part of the region and increases in the west.

Of the South's 201 million acres of commercially productive forestland, 11 percent is managed by various government agencies. The remaining 89 percent is privately owned: 22 percent by forest industry, 21 percent by farm-

ers, 12 percent by other corporations, and 45 percent by other individuals. Ownership is changing, with a decrease in forest industry ownership between the 1980s and 1990s and an increase in other corporate owners, including timber investment management organizations. Early results from the most recent forest inventories indicate that decreases in forest industry

ownership are continuing (fig. 6).

Broad forest types. Although total forest area has remained relatively constant, the distribution of forest types has changed (fig. 7). The area of upland forest has increased gradually. The area of lowland hardwoods declined somewhat between the 1950s and 1970s but has since leveled off. The area of naturally regenerated pine stands decreased by about half as the result of natural succession to upland hardwoods, harvesting of pines, and conversion to nonforest uses or planted stands following harvest. Planted pine increased from about 2 million acres in 1953 to 32 million acres in 1999. Between the 1980s and 1990s, pine plantations were established on land that was previously hardwood or mixed pine-hardwood forests (47 percent), natural pine forests (28 percent), and agricultural fields (25 percent).

The area of pine plantations is forecast to increase by 67 percent to about 54 million acres in 2040. Areas of other forest types are expected to decline at gradual rates over this period. Forests of all types will be lost to urban uses, and gains in planted pine will come mainly from cropland.

Landscape structure. A satellite snapshot of forest cover in the early 1990s indicates areas where forest is highly contiguous (fig. 8, p. 12): the Blue Ridge Mountains, the Cumberland Plateau, the Allegheny Mountains, the Ozark-Ouachita Highlands region, and some coastal areas.

Forest cover is highly fragmented, however, in the Piedmont, Central Tennessee, and the Ridge and Valley ecoregion. Forecast population growth coupled with current conditions suggests that the Piedmont will be especially susceptible to increased fragmentation through 2040.

Forest inventory Southern forests accumulated considerable volumes of timber between the 1950s and 1990s. Inventory grew by 73 percent from 148 billion cubic feet to 256 billion cubic feet, reflecting rapid growth of stands established since the 1930s. Recent inventories indicate a general slowing in the rate of accumulation for hardwoods and a leveling off of accu-

mulation for softwoods.

Forecasts indicate that regionwide, softwood growth will overtake and exceed removals by a slight margin in the next few years. As a result, softwood inventories are forecast to increase steadily between 1995 and 2040. Hardwood removals are forecast to outstrip growth by about 2025. Thus, inventories may peak about 2025 and then decline to levels just exceeding current amounts by 2040.

High-intensity management has increased southern timber yields as much as 65 percent over standard site preparation and planting and 100 percent over naturally regenerated forests.

Future productivity will determine both future forest conditions and forecasts of timber markets. For example, models indicate that, if anticipated productivity gains are not realized, the result would likely be more pine plantations to meet demands for timber products. The effects of environmental and climate change and pest-related mortality on productivity are uncertain.

Terrestrial Ecosystems

Observed trends and forecasts both indicate that certain southern forest types—including upland hardwoods and mixed pine-hardwood types—will decline somewhat but remain abundant. Planted pine will continue to expand. Conservation concerns focus on the structure and function of these abundant types and on some increasingly rare terrestrial communities.

Southern pine beetle will continue to be an economically important pest. Epidemics are likely in pines planted outside their natural range and without active management. Spillover epidemics from public land may continue to be problematic. The complex of nonnative insects and diseases affecting hardwoods has the potential to restructure upland hardwood forests, especially in the northern part of the region.

Rare forest communities. Many concerns about southern wildlife and plant species focus on rare forest communities. Fourteen critically endangered communities have lost more than 98 percent of their habitat since European

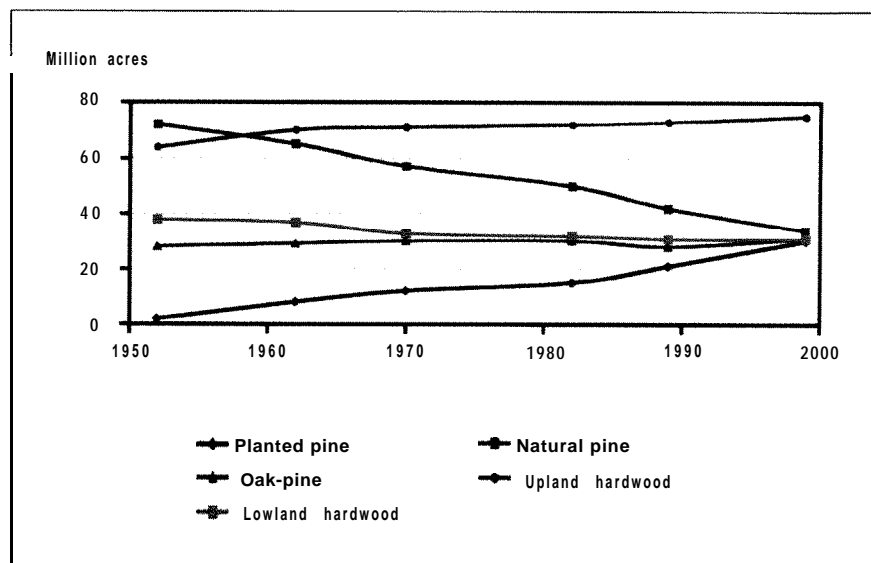


Figure 7. Trends in area of timberland by broad management type, all owners, southern United States, 1953 to 1999. Source: Wear and Greis (in press).

settlement. Most are in seven classes: (1) old-growth; (2) spruce-fir; (3) wetlands, bog complexes, and pocosins; (4) bottomland and floodplain forests; (5) glades, barrens, and prairies; (6) longleaf pine forests; and (7) Atlantic white-cedar swamps.

Two of the seven classes—old-growth and spruce-fir forests—are found largely on public land. The rest are generally in private ownership, so their future depends on the decisions of numerous owners. Spruce-fir appears to be under the most stress, mainly from a combination of air pollution and an exotic insect—the balsam woolly adelgid. Remnant longleaf pine forests are threatened by urban development and fire exclusion.

Effects of land-use changes. Urban land uses affect bird populations through loss and fragmentation of habitat and increased disturbances. Exotic animals, including feral cats, dogs, and pigs, influence wildlife through predation, displacement of natives, and habitat modification.

Forecasts of land-use change suggest that bird species in the Piedmont may be most affected, with declines anticipated for neotropical migrants and forest interior specialists.

Effects of forest management. Forest management can have important implications for wildlife, depending on site conditions and management practices. Broader landscape patterns can

influence mobile wildlife species. Fragmentation effects of certain practices are likely to be less in heavily forested areas than where urban and agricultural uses predominate, such as the Piedmont, Interior Low Plateau, and Mississippi Alluvial Plain. Landscape configuration and impacts of management may be especially high for some species, especially certain amphibians. Across the South, more species are threatened by increased isolation of shrub-scrub and grassland habitats than are affected by scarcity or fragmentation of mature forests.

The ultimate challenge for forest management is to support the array of grassland, shrub-scrub, and mature forest species occurring within the same landscapes.

Wildlife species of concern. Of the 1,208 vertebrate species known to exist in the South, 132 are “of concern,” and 28 are critically imperiled. The South is the center of amphibian biodiversity in the United States, and 54 amphibians are classified as species of concern, with 19 critically imperiled. Areas with a high concentration of endangered species include the Southern Appalachians, Atlantic and Eastern Gulf Coast Flatwoods, Gulf Coast Marsh and Prairie, and Peninsular Florida (fig. 9, p. 12). Loss of habitat from land-use conversion or modification is the primary threat.

Habitat protection will be a challenge in the face of the rapid urbaniza-

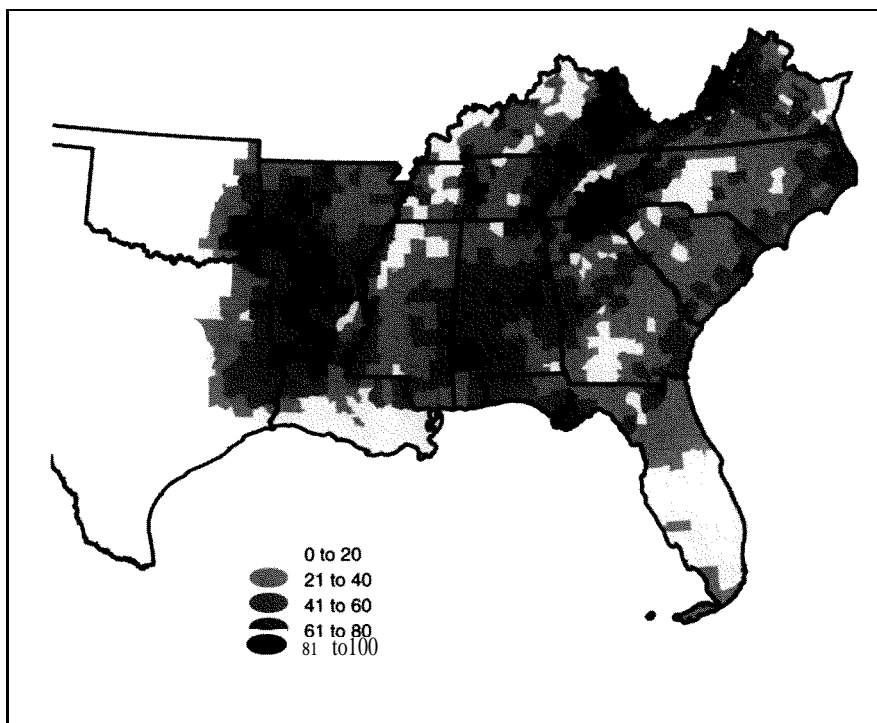


Figure 8. Percent of interior forest by county, 1992. Source: Wear and Creis (in press).

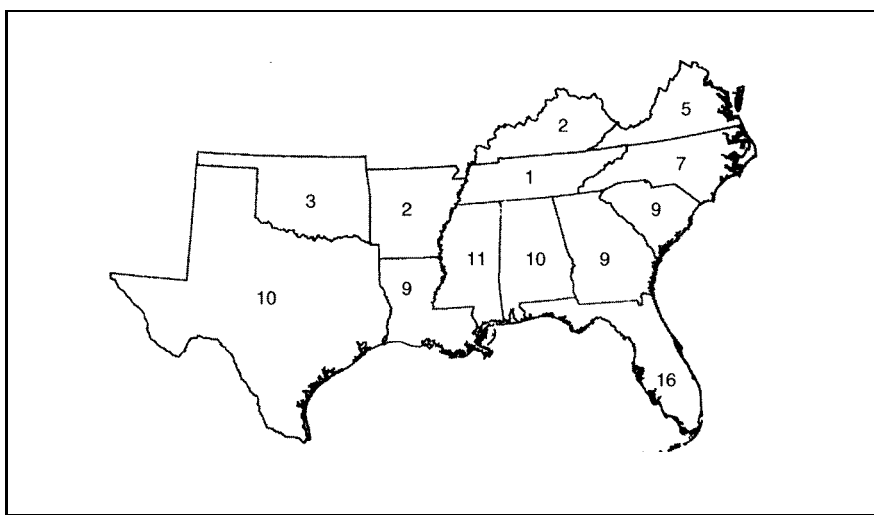


Figure 9. Number of terrestrial vertebrates in southern states listed as endangered, by state.

Source: Wear and Creis (in press).

tion forecast for the South. Forestry operations can have impacts on certain amphibians, especially those that depend on both wet and upland habitats.

Public land being relatively scarce in the South, more often it is the management of private land that determines the future of imperiled species and rare forest communities. Nevertheless, public land has unique ecological value because it can provide a dependable supply of interior forest habitat and older

forests. In urbanizing areas, public tracts can serve as anchors or core areas for conservation strategies pursued by multiple owners. The effective reintroduction of fire to many forest ecosystems will remain a critical forest conservation challenge.

Water Quality, Wetlands, and Aquatic Ecosystems

Water quality. Nonpoint source pollution continues to impair the region's surface waters, and of the 10 major

sources, agriculture and urbanization have ranked highest, with silviculture ranking next to last. Water flowing from forestlands in the South is of higher quality than that from other land uses.

Where evaluated, properly implemented silvicultural best management practices (BMP) have been effective in controlling nonpoint source pollution from forestry activities. Twelve of the southern 13 states have monitored BMP compliance. Survey methods have differed, however, and thus regional trends cannot be reported. Six states have now adopted similar procedures.

Wetlands. Approximately 32.6 million acres of forested wetlands occur in 10 southern states (Virginia, Texas, and Oklahoma are omitted), representing 64 percent of the total in the conterminous United States. Forested wetland losses have been widespread but concentrated in the Mississippi Alluvial Valley and the Coastal Plain of the Carolinas. Rates of losses have declined since the 1970s, but impacts and functional changes continue.

Land management practices and urbanization are expected to continue to alter the function of wetlands. Wetland restoration efforts will continue, but their likelihood of success is not yet clear. Forest management practices will play an especially important role in the persistence of certain wetland-dependent amphibian species.

Aquatic species of concern. The South supports a great diversity of aquatic life. Several hundred species of concern are found among the region's amphibians, mussels, crustaceans, fish, snails, and aquatic insects. Especially high concentrations of critically imperiled species occur in mussel, fish, and amphibian biota whose aquatic and wetland habitats have been modified (fig. 10).

For many mussels and some other species, declines will continue because of essentially irreversible actions—damming, agricultural conversions, and the introduction of nonnative species. Many aquatic species of concern are narrow endemics. The effects of development and management may be disproportionately high for the small areas they occupy.

DISCUSSION and CONCLUSIONS

The findings of the assessment led us to some broad observations about the status and future of southern forests.

1. The South is an economically, culturally, and ecologically complex region, and multiple forces of change are simultaneously affecting forest conditions.

2. Urbanization presents a substantial threat to the extent, condition, and health of forests. Among forces of change, it will have the most direct, immediate, and permanent effects.

3. Population is growing and the social context is changing, with implications for the values and demands that people place on forests as well as the uses of forests.

4. Total forest area will remain relatively stable on a regional scale, but subregional and compositional changes will continue. In particular, losses of forests to urban uses in the eastern region are forecast to be largely offset by shifts from agriculture to forest in the western regions. Overall, the region will experience a westward shift in its forest area.

5. Timber production is forecast to expand but will not deplete forest inventories below current levels. Between 1995 and 2040, softwood outputs will expand by 56 percent and hardwood outputs by 47 percent. Softwood inventories will continue to expand throughout. Hardwood inventories will expand until 2025 and then decline slightly between 2025 and 2040. These trends vary considerably among states in the region.

6. Investment in pine plantations is forecast to expand. Pine plantations enhance timber productivity—they accounted for 15 percent of timberland but contributed 35 percent of annual softwood removals between the 1980s and 1990s—but also cause ecological changes, depending on stand origin and management. These effects are better understood at the forest stand level than at a broader landscape scale.

7. Changing land-use and harvest patterns will have important impacts on people. The wood products industry currently accounts for about 6 percent of jobs and 8 percent of income. In some rural areas, however, it constitutes

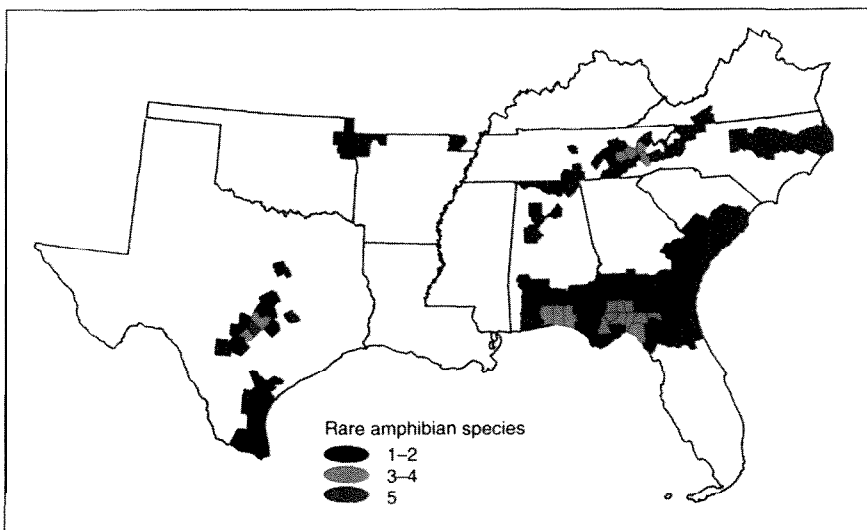


figure 10. The rare aquatic amphibians have three areas of concentration in the South: central Texas, the southern Appalachian Mountains, and the Panhandle of Florida.

Source: Wear and Greis (in press).

a majority of the local base economy. Forests also contribute to the quality of life in the region by providing recreation, aesthetic, and environmental benefits. Forecasts of increasing timber harvests imply more jobs in the wood products sector. However, abrupt changes in forest conditions could lead to costs for some people, benefits for others, and increased debate over forest uses in areas outside the traditional production core of the South.

8. Southern forests have proven resilient, but some components are scarce and therefore at risk. In the 20th century, the South recovered from a largely cutover, exhausted, and eroded condition to become one of the most productive forest regions in the world. However, the presence of numerous imperiled animal species and increasingly rare forest communities are reasons for concern.

9. Scarce forest types have high ecological value. To borrow an adage from economics, scarcity defines value. The rare forest communities in the South have disproportionately high ecological value. Thus, much concern about biodiversity is focused on these relatively small shares of the forest landscape.

Subregions of Concern

The assessment allowed us to identify three areas in the South where concerns regarding forest sustainability may be especially high: the Southern

Appalachians, the Piedmont, and the Lower Atlantic and Gulf Coastal Plains.

Implications for Forest Research

Unlike most bioregional assessments conducted in the United States to date, which have been motivated by a crisis of one sort or another, SFRA can be viewed as an “anticipatory assessment” (Estill, as cited in Johnson et al. 1999). It was intended to provide information to illuminate a dynamic resource situation and illustrate critical areas before an actual crisis erupted.

SFRA was successful in describing several emerging issues that could affect the sustainability of the South’s forests, but more information is needed to better identify problems and potential solutions. The following are major areas of uncertainty:

- The effects of population growth on forest ecosystems.
- The influence of changing market and other values on land-use and management choices.
- The determinants of overall forest productivity for all benefits.
- Forecasts of changes in ecological structure and functions.
- Impacts on a broader scale, necessary to better address questions at regional levels.
- The role of fire in forests and its effective use.
- The influence of changing forest

structure, especially pine plantations, on ecosystem function and wildlife.

- The potential of new forest management strategies for a variety of settings.

The assessment highlights our inability to link findings in a fully integrated, multidisciplinary analysis of forest ecosystems and thus address the full complexity of this dynamic and highly diverse region. Such an integrated analysis would, for example, allow us to evaluate the impacts of expanded wood products demand on the distribution and condition of wetlands and subsequently on the distribution and persistence of related species. Our inability to make these causal links reflects a shortcoming of ecosystem and resource science in general that is, at its root, the result of current forms of scientific investigation. Here lies a challenge for the South's forest research community.

literature Cited

- JOHNSON, K.N., F. SWANSON, M. HERRING, and S. GREENE. 1999. *Bioregional assessments: Science at the crossroads of management and policy*. Washington, DC: Island Press.
- NATIONAL RESEARCH COUNCIL. 1998. *Forested landscapes in perspective: Prospects and opportunities for sustainable management of America's nonfederal forests*. Washington, DC: National Academy Press.
- WEAR, D.N., and J.G. GREIS. In press. *The Southern Forest Resource Assessment: Final report*. Asheville, NC. Draft available at www.srs.fs.fed.us/sustain.

David N. Wear (dwear@fs.fed.us) is coleader, Southern Forest Resource Assessment, USDA Forest Service, Southern Research Station, Box 12254, Research Triangle Park, NC 27709; John G. Greis is coleader, Southern Forest Resource Assessment, USDA Forest Service, Southern Region, Atlanta, Georgia. The full SFRA draft report is available at www.srs.fs.fed.us/sustain.